OPERATING INSTRUCTIONS

ALLISON
MODEL 2AB (R)

CONTINUOUSLY VARIABLE FILTER

ALLISON LABORATORIES, INC.

TRACOR

6500 Tracor Lane, Austin, Texas 78721, AC 512/926-2800

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CONTINUOUSLY VARIABLE FILTER

ALLISON LABORATORIES, INC.

Subsidiary of

TRACOR, Inc.

6500 TRACOR LANE

AUSTIN, TEXAS 78721

INSTRUCTIONS FOR ALLISON MODEL 2 SERIES FILTERS

WARRANTY

All Allison filters are warranted by the manufacturer for one year from date of purchase against defects of material, workmanship and conformance to specifications. The warranty shall be for the repair or replacement of defective materials at the discretion of Allison Laboratories, Inc. All warrantees are FOB the manufacturer's plant.

1. GENERAL DESIGN

The Allison Models 2AB, 2B, 2C and 2D are each composed of two separate filter networks: A low cutoff double K section filter and a high cutoff double K section filter. These may be connected together externally. Tuning is accomplished by a patented variable inductor. The passive networks, humbucking construction and shielding allow operation with low level signals at a wide dynamic range. The design of these filters is such that they have a minimum ringing effect which enhances their ability to analyze transients.

2. OPERATION

2.1 CONTROLS

The low cutoff and high cutoff sections are isolated from each other and from the case. Buss bars are provided to connect the two in series. To operate the sections as individual filters or in different parts of a circuit, remove the buss bars. Each filter is provided with two controls, an octave band switch and a multiplier dial. The octave band switch changes the cutoff frequency in octave steps. The multiplier dial tunes the cutoff frequency over one octave. The multiplication factor on the dial times the octave band setting gives the cutoff frequency. This may be obtained without calculation from a chart that is provided. For example, if the octave band switch is set to 300 cps and the multiplier dial is set to 1.8, the resultant cutoff frequency will be 540 cps. (refer to chart). The cutoff frequency is defined as that frequency at which the filter attenuates approximately 3 db from the minimum insertion loss.

2.2 BAND PASS

The minimum pass band that may be obtained without increasing the insertion loss is approximately 1/3 octave. If the low cutoff and the high cutoff sections are set at the same frequency, the bandwidth will be approximately 1/4 octave. Narrower bands may be obtained, providing additional loss is permissible. A 10 db pad on the binding posts between the high cutoff and low cutoff sections of the filters will give a minimum pass band of approximately 1/5 octave.

3. ATTENUATION

The attenuation of these filters is at least 30 db per octave. In the high cutoff filter, the attenuation rate will increase slightly with an increase in cutoff frequency. Also, there will be an increase in attenuation rate with an increase in the multiplier dial setting. There is an increase in efficiency or Q of the filter with increased frequency and at the higher end of the multiplier dial. In the low cutoff filter, there is less change in attenuation rate with different frequency settings, but an increase in the efficiency of the filter at the lower settings of the multiplier dial. For maximum efficiency of the filters, if possible, use the lower half of the multiplier dial for the low cutoff and the upper half of the multiplier dial for the high cutoff. This will give the best attenuation rate and the least insertion loss. In case higher attenuation rate and sharper cutoff are needed, two or more of these filters may be hooked in series to provide a minimum of 60 db for two, etc. (see Figure I, Page 7). Where extremely high attenuation is desired outside of the pass band, it is important to have only one ground on the common side of the test circuit. The case should also be connected to this point.

4. ACCURACY

The steep attenuation slope and effective load restrict the accuracy of the nominal setting. Where greater accuracy is desired, we suggest using the test circuit or circuit that the filter is working into for setting the multiplier dial to the desired exact frequency. If more than one exact cutoff frequency is used on the dial, greater reliability will be obtained by approaching each setting from the same direction.

The ferrite cores in these filters have a slight temperature coefficient that varies with the multiplier dial setting. These filters should be calibrated at normal room temperature. If desired to operate at temperature extremes, use test circuit for setting multiplier dial at the operating temperature.

5. POWER HANDLING CAPACITY

The power handling capacity of each filter is limited primarily by the amount of distortion that can be tolerated. With 10 volts into the 600 ohm filter the distortion will be approximately 1%; at 1 volt or less it will be less than .1%. We recommend these filters be placed in a low level portion of the test circuit.

6. HUM AND NOISE

As the passive networks do not generate any appreciable noise, noise has to be introduced externally. Humbucking construction in the inductors effectively cancels most pickup. This, in combination with the shielding of the steel case, allow very low level measurements to be made. Measurements 120 db below 1 volt can be performed adequately. When making low level measurements, it is important to have only one ground on the common side of the test circuit. A ground loop may limit

the maximum possible attenuation in the filter to as low as 40 db. The cores in these filters are slightly magnetostrictive and when operated at a high level, may sing at some frequencies. This does no harm except precautions may be necessary if the amplified output of a microphone circuit is connected to the input of the filter. The sound coming out of the filter may go back into the microphone and cause feedback.

7. IMPEDANCE MATCHING

In passive network filters, a change of impedance is part of the filtering action. It is very important that the source impedance and the load impedance be 600 ohms to match the filter. The impedance of the filter will change radically outside of the pass band.

7.1 INPUT (SOURCE)

When working from a very low impedance, a 600 ohm series resistor on the input will provide the proper source impedance for the filter. The most common error found in source impedance results from the use of an amplifier to feed the filter. Many amplifiers are marked 600 ohms on the output, but have feedback on the output stage which, in some cases, reduces the impedance to as low as 60 ohms. These amplifiers will work correctly into a 600 ohm load, but they do not terminate the load in 600 ohms. The impedance of such an amplifier can be determined by placing a pure tone signal on the amplifier and using a voltmeter and a decade resistance box on the output. Adjust the output voltage to an easily read figure, then place the decade box in as a load resistance and adjust until the voltage has been dropped to 1/2; the decade box should then read the true output impedance of the amplifier. We would suggest using a series resistor to make the difference between that and 600 ohms. If the impedance value is over 600 ohms, we recommend that a different amplifier be used with the proper output impedance.

7.2 OUTPUT (LOAD)

Working the filter into a high impedance load offers no problem as a 600 ohm resistive load placed across the output will correctly load the filter. A difficulty similar to the one mentioned in 7.1 above occurs in load impedances. The input of an amplifier may be marked 600 ohms, and may work properly when working out of a 600 ohm source but if the secondary of the amplifier input transformer is not terminated, the filter, instead of being terminated in 600 ohms will be terminated in impedance represented by the transformer primary. Since the primary of the transformer looks like an inductance, the impedance will vary with frequency; the higher the frequency, the higher the impedance. In order to correct this condition, the output of the filter should be terminated in 600 ohms in addition to the filter being connected into the input of the transformer on the amplifier.

7.3 HIGH IMPEDANCE CIRCUITS

When it is necessary to use the filter in circuits where either or both the input or output circuits are high impedance, the use of Allison Model AL-483 Autotransformer and/or AL-484 Transformer is recommended. The Model AL-483 plugs into the input of either filter and gives an input impedance of 12,000 ohms and the secondary matches the 600 ohms of the filter. The Model AL-484 Output Transformer has a 600 ohm input resistance, and a 47,000 ohm output and is suitable for working into a high impedance grid circuit. This transformer is loaded internally with a 600 ohm resistive load so that the output load is not critical. The input and output windings of this transformer are isolated so that if there is no common between the input and the output circuit in which the filter is used, a strap should be placed from the black post on the filter output to the black post on the AL-484 Transformer. If the common side of the input and the output circuitry is connected, the strap should be omitted. These transformers plug into the binding posts on the front of the filter allowing the filter to be used either with or without the transformers. These transformers are flat only from 20 to 20,000, therefore, have a limited use on the 2D Filter (see Figure II for connections).

8. RACK MOUNTING

When these filters are mounted in a rack, it is possible to introduce noise into the circuit if there is difference in potential between the rack ground and the common side of the filter. This usually can be eliminated by proper placement of a ground on the common side of the test circuit.

9. BAND REJECTION

These filters cannot be paralleled directly for use as band reject filters, since the input and output impedance of the passive network filters deviate radically from 600 ohms outside the pass band. To obtain band rejection, it is necessary to feed each low cutoff and high cutoff filter from separate amplifiers. In this case, a 600 ohm terminating resistor should be placed across the output of each filter. Under this condition the frequencies at which the high cutoff and the low cutoff filters are set will be the reject band instead of the pass band. For example, if the low cutoff filter were set at 10 kc and the high cutoff filter set at 5 kc, the 5 to 10 kc would be the band rejected.

10. TEST

The most common difficulty experienced by our customers has stemmed from improper test procedures. The frequency response characteristics of passive network filters is determined by the source and load impedance. The circuit in Figure III, Page 8, should be used for testing the frequency response of the filters. This circuit is recommended by the American Standards Association for testing filters. After setting up the circuit, the test procedure is as follows for band pass operation.

10.1 Set up the circuit as shown in Figure III, Page 8. Be sure that input voltmeter (V_1) is on the generator side of the source impedance resistor. The generator voltage should be held constant so that the effective generator impedance will be zero.

10.2 Determine the insertion loss by switching the filters to "OFF", and then set oscillator frequency to the center of the pass band. Take a reading of the output voltage (V_2) with constant input voltage. Turn the switches to the desired band and take a second output reading with the same input voltage. The voltage difference between the two readings is the insertion loss. The ratio of the two output readings can be used to determine the loss in decibels. The formula for this conversion is log. $20 \times \frac{E_1}{E_2}$.

10.3 Vary the frequency of the oscillator to the low cutoff point and with the same input voltage the reading should be approximately 3 db greater than the minimum insertion loss. (The 3 db down point is the one-half power point).

10.4 Again vary the frequency to one octave below the low cutoff frequency and with the same input voltage the loss should be greater than 30 db below minimum insertion loss.

10.5 Repeat the above steps 3 and 4 except at the high cutoff frequency and two times the high cutoff frequency. The same 3 db and greater than 30 db should be obtained. Additional points may be plotted in the same manner.

10.6 For checking operation as single filter, turn the unused filter to OFF and the same general procedure is used. Minimum insertion loss is taken one octave into the pass band.

10.7 For further information on the testing of these filters, refer to American Standards Association Specification Z24.10-1960, "Octave Band Filter Set for the Analysis of Noise and Other Sounds".

11. SERVICE

11.1 GENERAL

Passive filters require very little service and are quite rugged. Severe shock is required to damage the units. Normally adjustment of the multiplier dial is all that is required and the method for accomplishing this is outlined below. Severe damage to the variable inductors due to shock usually shows up as cracked or broken ferrite cores. If this is encountered, it is suggested that the filter be returned to the factory for repair and recalibration.

11.2 TROUBLE SHOOTING

11.2.1 No output: A. Setup filter test as shown on page 8. Check individual filters at input and output to isolate general area. If band pass is being used, be sure buss bars between low cutoff output and high cutoff input are in place and making connection. B. If one or both

filters show no output, remove the case by removing screws around the trim ring (portable) or in the edge of the case just behind the panel (rack mount). Lift filter out of the case. Trace the circuit using the schematics and drawings enclosed. Deck A on each switch is nearest the front panel. It should be noted that either capacitor C_A or C_C are used in adjacent bands by switching. Common troubles and probable causes are listed below.

A. No output in low cutoff section.

Broken wires, open capacitors, or switch contacts in Decks A, J or K.

B. Loss of attenuation - Low cutoff section.

Open circuits through the inductors to common.

C. Dips in pass band or in attenuation curve.

Improper termination; see item 7.

D. No output in high cutoff section.

Open wires or inductor coils. Check through switch by opening strapping to disconnect capacitors.

E. Loss of attenuation - High cutoff section.

Check for disconnected capacitors on the capacitor boards or through the switch.

F. Grating noise during multiplier dial rotation.

Dropping or rough handling can cause ferrite cores to chip on top adjacent to magnets in the variable inductors. These chips will cling to the magnets and when tuned to the 2.0 position, will rub on top of the cores. Open the case, remove the capacitor board (2 screws in each end of the board), and remove chips from magnet using small steel bar or the adhesive side of tape over a flat spatula type implement. Small chips (1/8 long or less) normally can be removed without changing the filter performance. Larger chips will cause added insertion loss or slight shift in cutoff frequency. Cracks in the cores usually will change frequency response out of tolerance and cores must be replaced (at factory).

G. Incorrect dial calibration.

If this is due to slippage, refer to Test (10) and follow first 3 steps. When the correct frequency is attenuated 3 db below minimum insertion loss (1 octave inside pass band or at center of a band pass) the dial (multiplier) should indicate the correct frequency. If it does not, the setscrew in the knob may be loosened and the dial rotated to the correct reading and retightened. It is suggested that this be done at the 2.0 position for 600 Hz signal and a 300 Hz switch position.

H. General cleaning.

Remove case as above and blow out any dirt, small wax chips or dust. Lubricate switch contacts with G. C. Sprakleen or equivalent. Do not use strong solvents such as lacquer thinner, acetone, etc. Lubricate worm and gear with light grease if necessary.

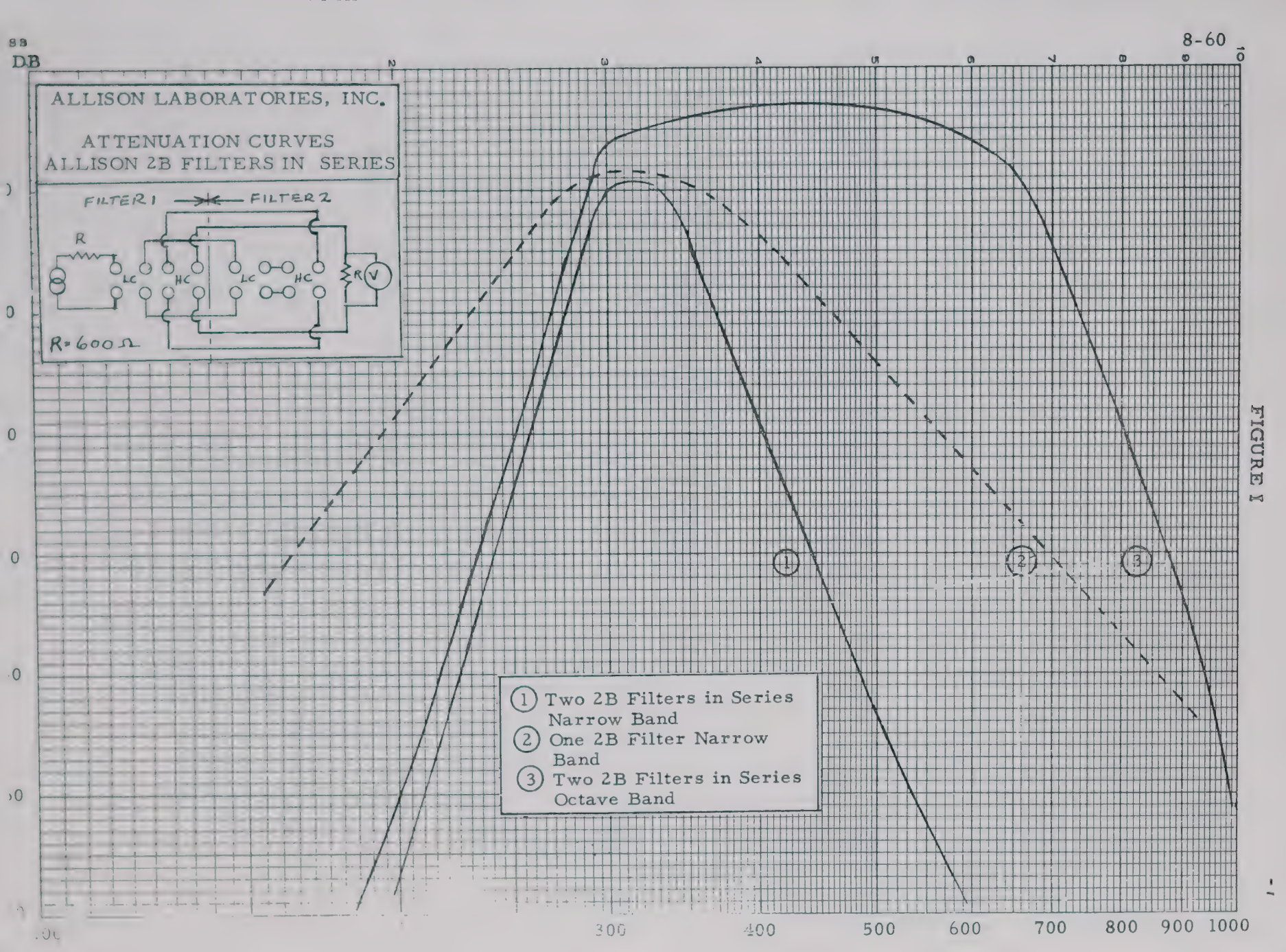
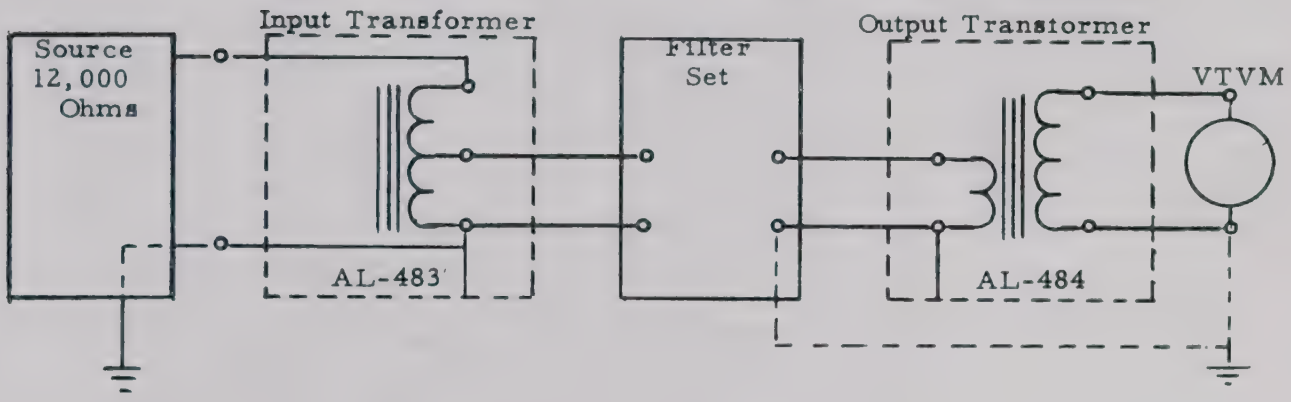

DB
ALLISON LABORATORIES, INC.
ATTENUATION CURVES
ALLISON 2B FILTERS IN SERIES
FILTER 1
FILTER 2
R
LC
HC
LC
HC
R
V
R = 600 Ω
1 Two 2B Filters in Series Narrow Band
2 One 2B Filter Narrow Band
3 Two 2B Filters in Series Octave Band
300
400
500
600
700
800
900
1000

FIGURE I

FIGURE II

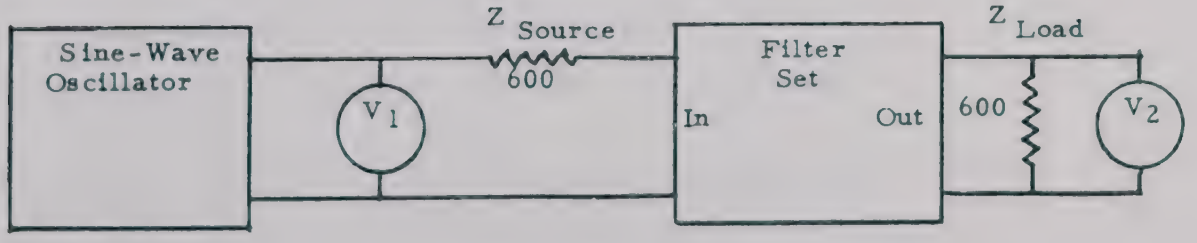
HIGH IMPEDANCE CIRCUIT CONNECTIONS



NOTE: TRANSFORMER RESPONSE IS FLAT ONLY FROM 20 CPS TO 20 KCPS

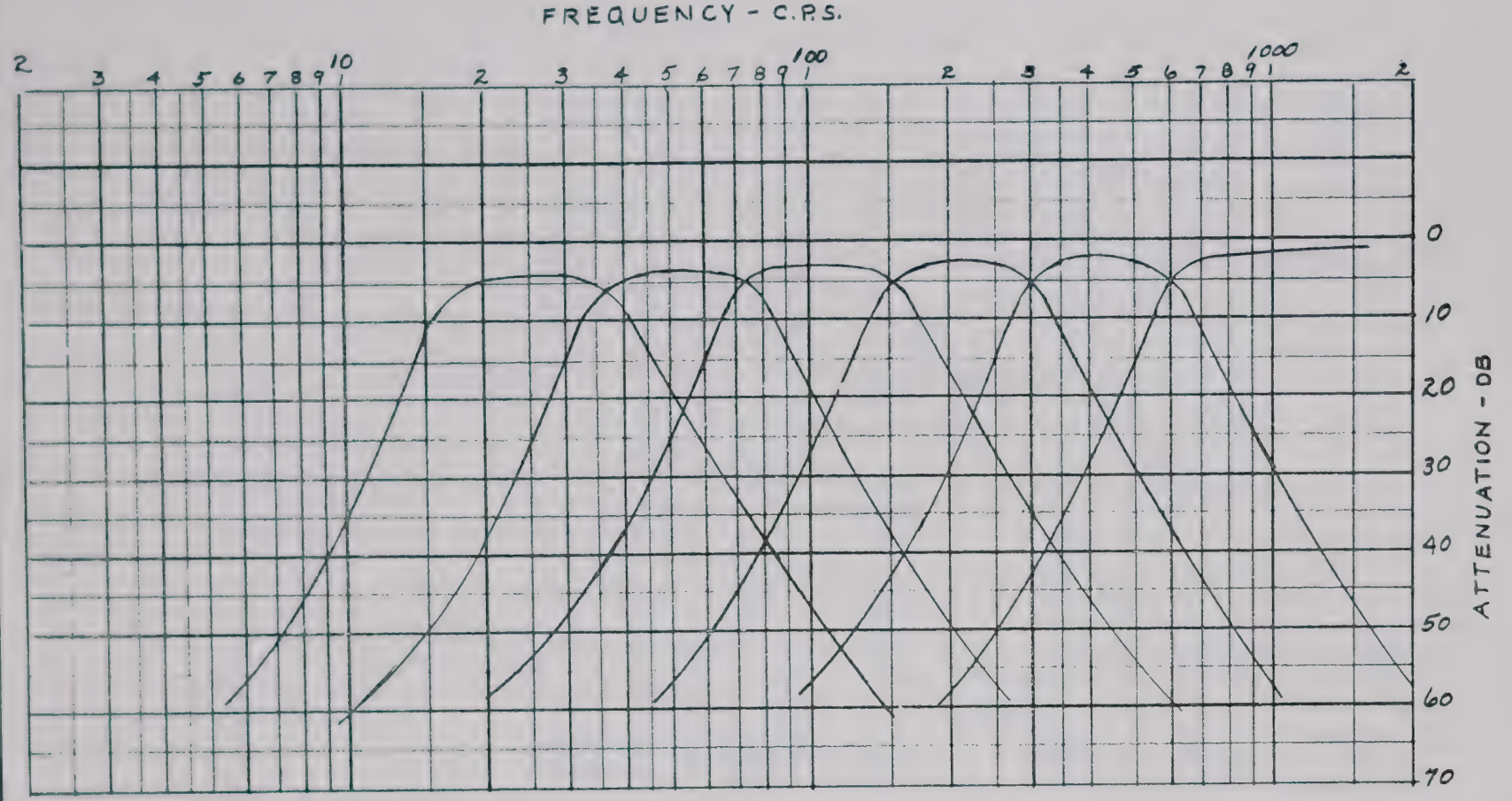
FIGURE III

FILTER TEST CIRCUIT



IMPORTANT

INPUT VOLTMETER MUST BE ON GENERATOR SIDE OF RESISTOR FOR CORRECT TEST RESULTS.



TEST CURVES

18.7	-	37.5
37.5	-	75
75	-	150
150	-	300
300	-	600
600	-	

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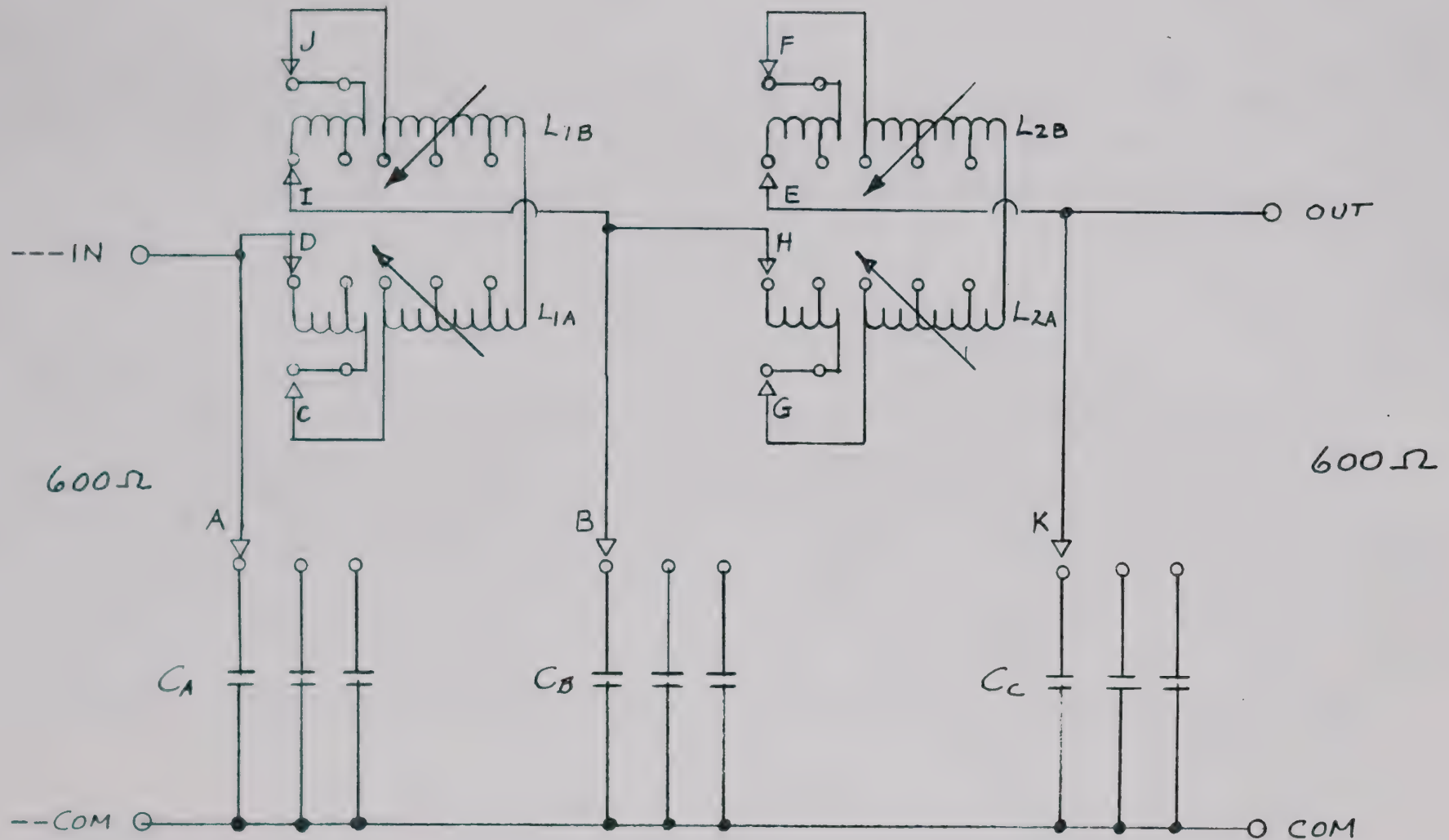
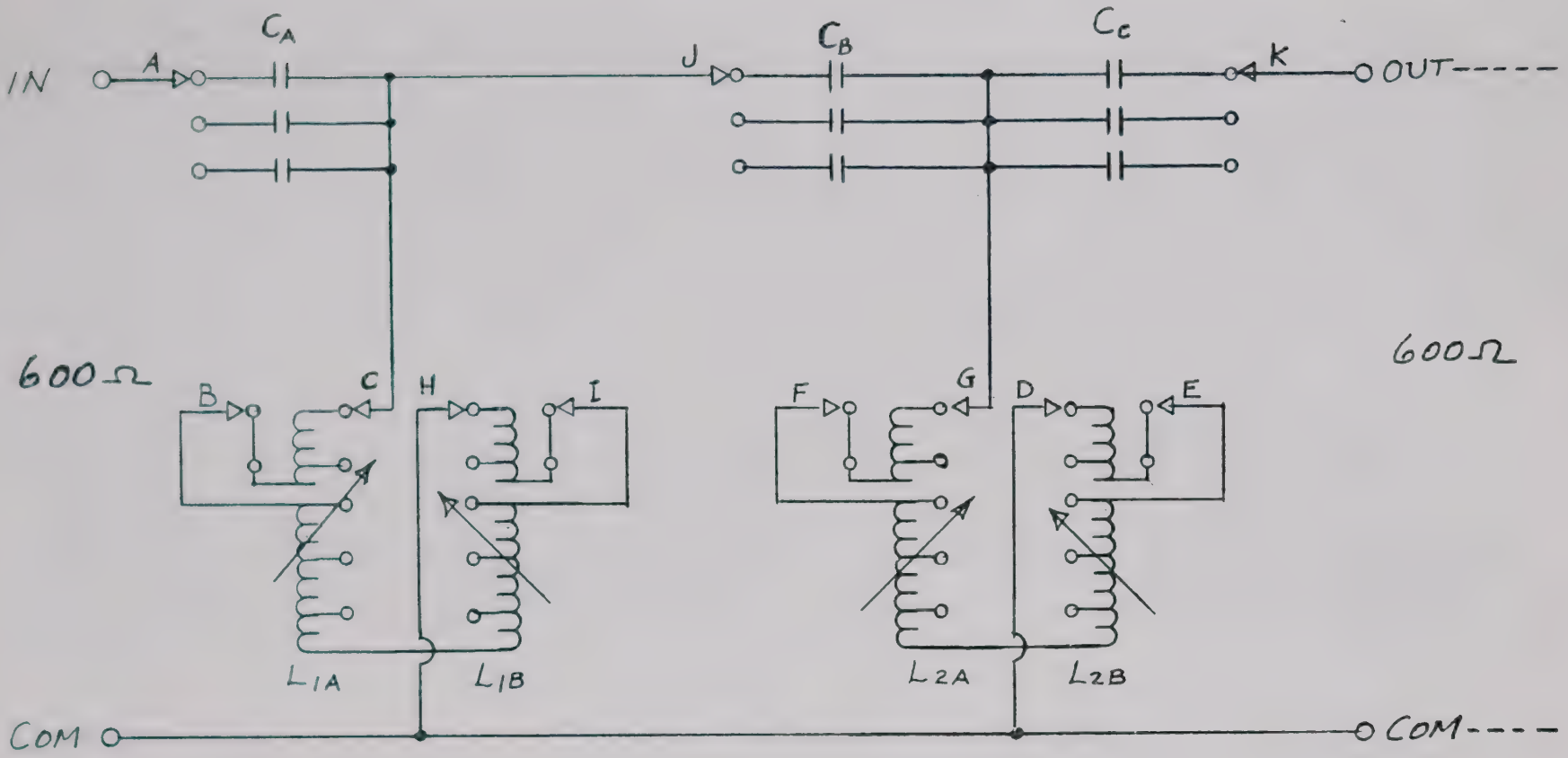
OCTAVE BAND CURVES
MODEL 2AB FILTER

EP 2/27/62 | | AL-653



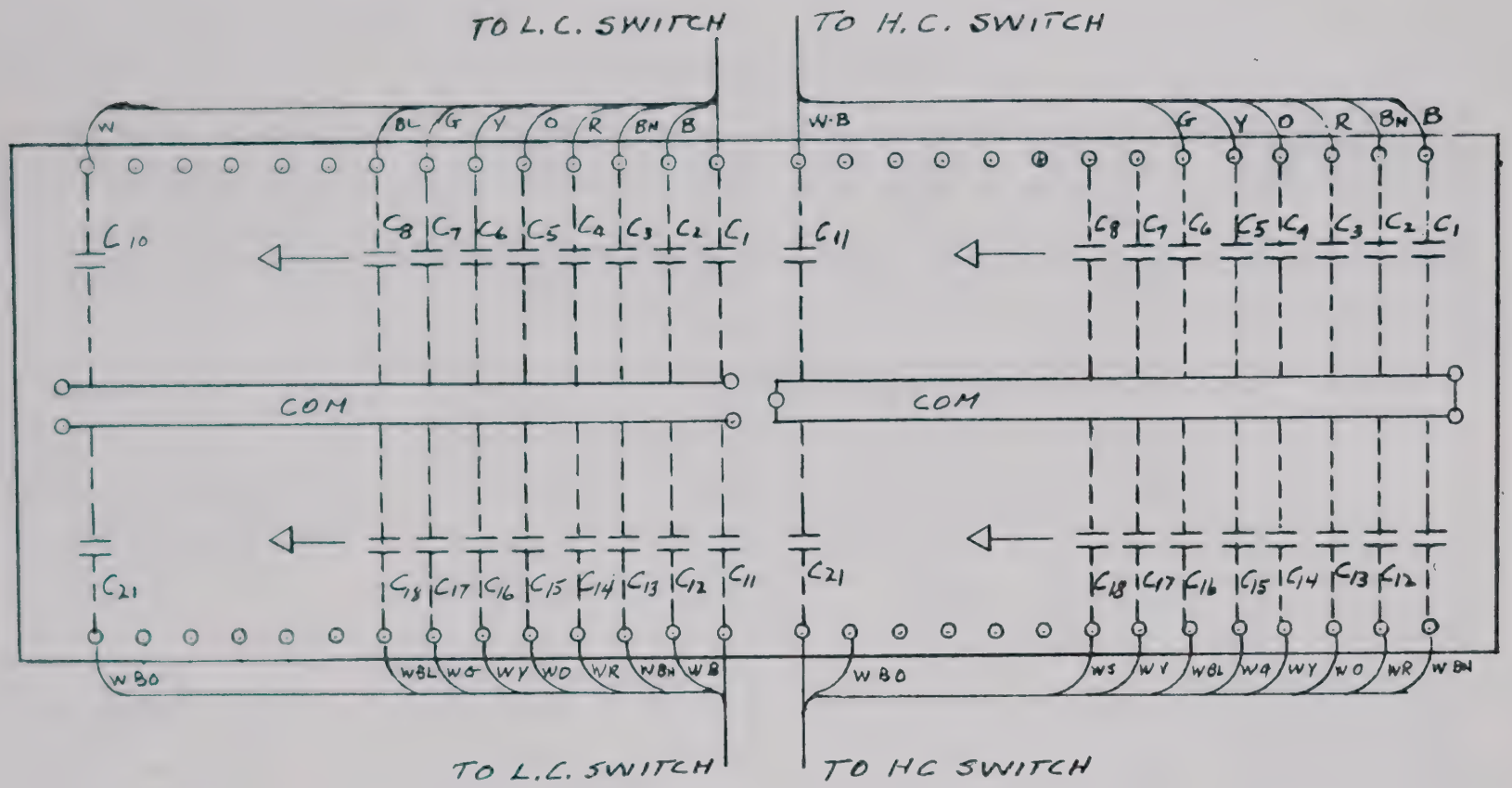
SCHEMATIC - HIGH CUTOFF

ALLISON 2 SERIES FILTERS



SCHEMATIC - LOW CUTOFF

ALLISON 2 SERIES FILTERS



VIEW FROM SWITCH SIDE

NOTE: CAPACITORS MAY CONSIST OF 1 OR MORE INDIVIDUAL UNITS FOR EACH C VALUE

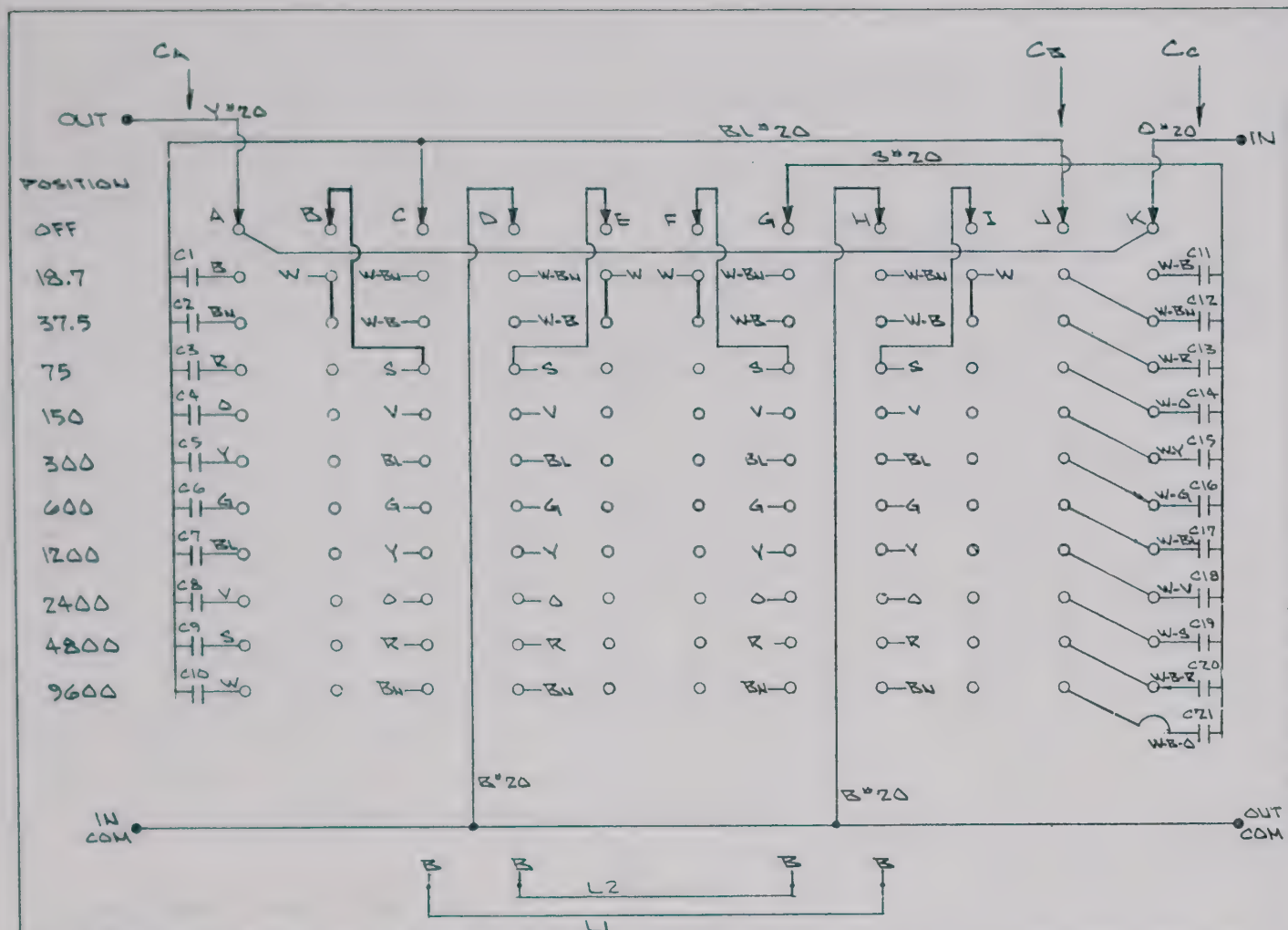
CAPACITOR LOCATION DIAGRAM

[illegible] FILTER

PARTS LIST - SERIES 2 FILTERS

PART DESCRIPTION	2AB 2ABR	2B 2BR	2C 2CR	2D 2DR	REQUIRED PER FILTER
Case - Rackmount	1937	1937	1937	1937	1
Case - Portable	1936	1936	1936	1936	1
Trim *	1910	1910	1910	1910	1
Handle *	2300-416-173	2300-416-173	2300-416-173	2300-416-173	1
Foot *	B2095W	B2095W	B2095W	B2095W	4
Panel - Rackmount	1208-3	1207-3	1211-3	1209-3	1
Panel - Portable	1208-2	1207-2	1211-2	1209-2	1
Index	1696-4	1696-4	1696-4	1696-4	2
Knob - Skirt	4107	4107	4107	4107	2
Dial & Knob Assem.	1203	1203	1201	1203	2
Switch Assem. L. C.	1085	1085	1096	1077	1
Switch Assem. H. C.	1086	1086	1097	1078	1
Inductor Assem. L. C.	1055	1056	1058	1057	1
Inductor Assem. H. C.	1049	1050	1052	1051	1
Board & Capacitor Assem.	1065-2	1065-3	1066	1067	1

* PORTABLE MODEL ONLY



4. THE FIRST TWO POSITIONS OF DECK B, E, F & I ARE USED TO CONNECT THE FIRST & SECOND SECTIONS OF THE SPLIT COIL FOR THE TWO LOWEST FREQUENCY RANGES. THIS IS DONE TO REDUCE DISTRIBUTED CAPACITY IN THE COIL AT HIGH FREQUENCIES.

3. FOR MODEL ZAB SET STOP TO ALLOW 11 POSITION OPERATION

2. FOR MODEL ZA SET STOP TO REMOVE LAST POSITION AND GIVE 10 POSITION OPERATION

1. THIS DWG. EFFECTIVE ZA SERIALS 2605 & UP & ZAB SERIALS 1218 & UP

NOTES:

USED

B1682F

(F) CHANGE: INPUT, YEL TO OR OUTPUT, OR TO YEL. CC 12/30/66

(E) ADD NOTE #4 C.C. 10-13-66

(D) CHANGE IN & OUT POSITION C.C 8-15-66

(C) ADDED SCHEMATIC TO TITLE CC 9-16-65

(B) REMOVED SWITCH NUMBER DY 8-5-65

REVISIONS

DRAWN	CHECKED	SCALE
CV	V.C.	NONE
10-25-62	S. ZA&ZAB	DATE 10/25/62

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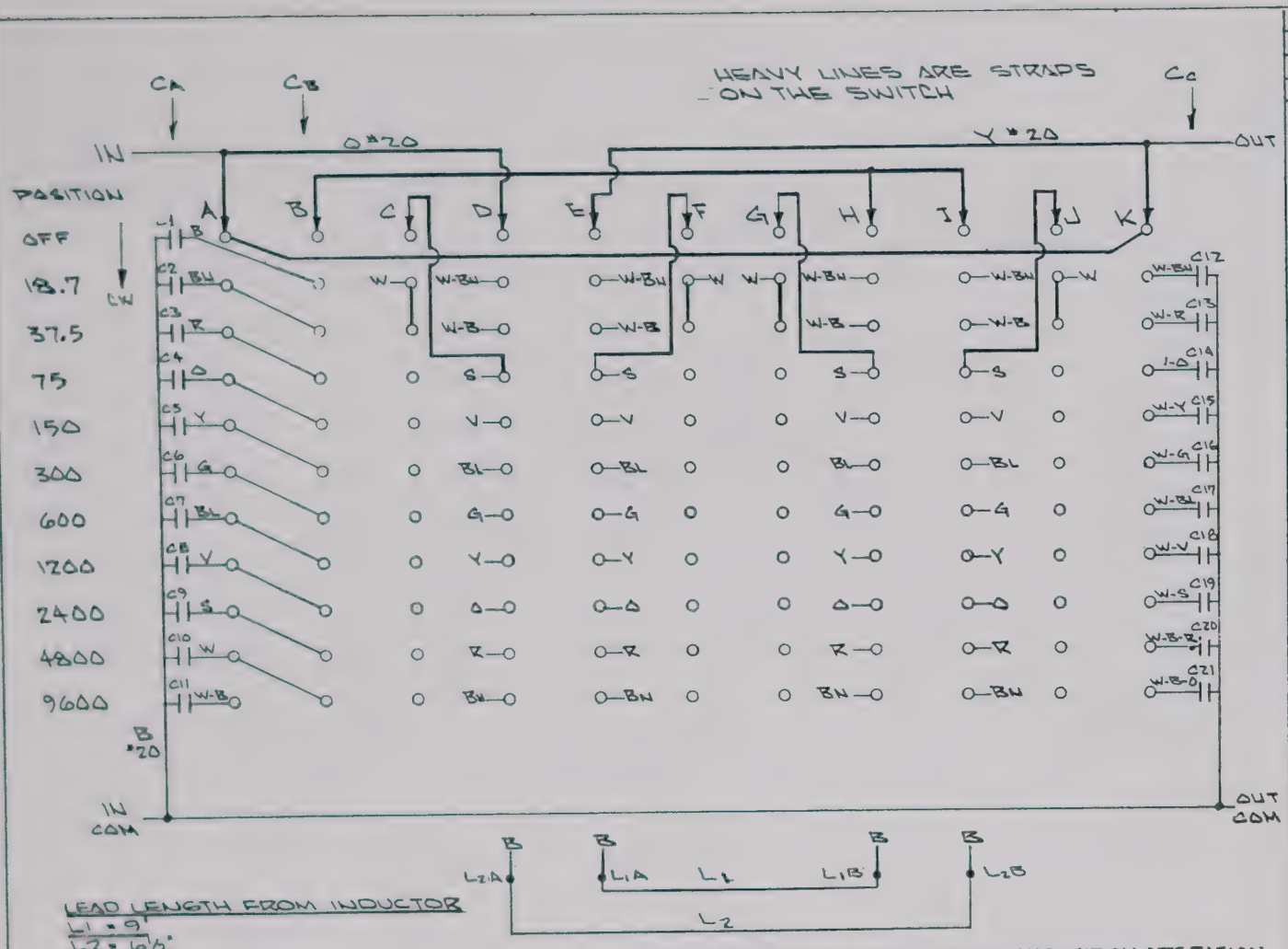
LA HABRA CALIFORNIA

SCHEMATIC - L.C.

MODEL ZAB FILTER

B 1682 F



LEAD LENGTH FROM INDUCTOR
L1 = 9"
L2 = 6½"

A. THE FIRST TWO POSITIONS OF DECKS B, E, F & I ARE USED TO CONNECT THE FIRST & SECOND SECTION OF THE SPLIT COIL FOR THE TWO LOWEST FREQUENCY RANGES. THIS IS DONE TO REDUCE DISTRIBUTED CAPACITY IN THE COIL AT HIGH FREQUENCIES.

3. FOR MODEL 2AB SET STOP TO ALLOW 11 POSITION OPERATION
2. FOR MODEL 2A SET STOP TO REMOVE LAST POSITION AND GIVE 10 POSITION OPERATION
1. THIS DWG. EFFECTIVE 2A SERIALS 2605 & UP & 2AB SERIALS 1218 & UP

NOTES:

USED

B1683C

(C)	ADD CALLOUTS & VIEW OF SWITCH CC 10-13-66
(B)	ADD LEAD LENGTHS TO INDUCTOR CC 5-11-66
(A)	REMOVED SWITCH W2 & CHANGED TITLE TO SCHEMATIC. CC 9-16-65

REVISIONS

DRWN	CHECKED	SCALE
CV 10-25-62	V.C. 2A & 2AB	NONE
		DATE 10-25-62

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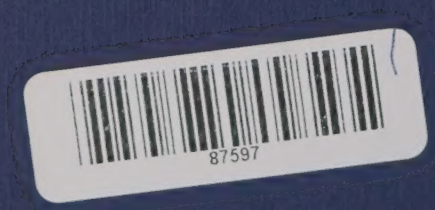
SCHEMATIC -H.C.
MODEL 2AB FILTER

B 1683 C

MP-77386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